Final Report to the Joint Fire Science Program
Project 04-2-1-71

Project Title:	Quality Assurance of Weather Data and the Probability of Favorable Weather for Prescribed Fire in Alaska.
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Overview:

Alaskan land managers interested in using prescribed fire cannot use many of the tools available to land managers in other areas due to the extremely limited amount of Alaskan RAWS and other station data in enterprise databases, such as the National Interagency Fire Management Information Database (NIFMID) and its associated systems, the Weather Information Management System (WIMS) and the data retrieval program KCFAST. Tools such as Fire Family+ and the Rare Event Risk Assessment Process (RERAP), that are used in determining quantities of interest for prescribed fire and timing of likely prescriptive windows, require data retrieved from the NIFMID database in their calculations. The lack of comprehensive local Alaskan observations within NIFMID means that managers cannot use these tools without extensive error checking and reformatting of whatever observations they might obtain elsewhere. This data quality assurance and repackaging effort is often prohibitive, resulting in the Alaskan RAWS and other station network information not being used to its full benefit.

This project focused on creation of a quality assured database of all available Alaskan weather stations. Data from 776 unique stations were collected from various sources and combined to form a single, coherent database spanning 101 years (1906-2007). This database is available through a website created for this project, allowing users to search for stations based on type, location, and more. Data can then be plotted, downloaded, or analyzed for the probability of prescription windows directly through the site. This website provides a unique resource for land managers in Alaska not previously available.

The database created for this project is the most complete and comprehensive collection of Alaskan weather station observations ever created. Journal publications are expected to highlight both the database and analyses, and

possible future applications include analyzing the data for climate trends and variability.

Project Findings:

New weather observation database

Alaskan weather station observations were collected from the WIMS database, the collected RAWS stations archived at the Western Regional Climate Center, and the Co-op and other stations archived at the High Plains Regional Climate Center. In all, 776 stations were obtained for the time span 1906-2007. These were reconciled for duplicate observations, and quality assured. Automated downloads of new data are performed through a new specialized web-scrubber/parser. An alternate solution that will push new data into the database is being developed for installation at the Alaskan Interagency Coordination Center. The resulting dataset is significantly more complete than the ~100 Alaskan stations currently available in WIMS.

Quality assurance routines automated

Quality assurance routines were developed to:

- Identify and reconcile data for the same station from different databases
- Eliminate unphysical values as bad data
- Identify and eliminate data from stuck or severely degraded sensors

These routines have been developed to run automatically. In addition, data can be manually quality assured, but only a few stations currently have these adjustments. Manual quality assurance was done by Sharon Alden of the Alaskan Interagency Coordination Center.

None of the quality assurance routines is data destructive. Instead both original and quality assured data are stored for archiving and future database development purposes.

All of the routines have been documented and are available for other researchers to use. The routines utilize only freely available software and libraries (PERL, NetCDF, FERRET, and R).

Data available through easy to use / searchable website

A new data portal website was developed (see Figure 1). It is reachable through the main project website at http//www.airfire.org/akraws. The data portal website contains links to a variety of Alaskan fire weather data and climate information.

Data access is provided through a Google Maps interface that allows the user to filter the stations shown based on type of station (e.g. RAWS vs. Co-op), and status (active vs. inactive). An individual station can be selected by zooming in on the map or via a list (see Figure 2). Once selected, a variety of information on the station is shown and access to the station data can be obtained (see Figure 3).

Station data can be downloaded as:

- Comma separated value format
- NetCDF format

Many programs including Excel and Fire Family + can utilize comma separated value data, making this a relatively universal choice. However, additional data formats are easily added if requested in the future by users.

Station data can be plotted in a variety of ways. Currently there are 4 standard multipanel plots the user can choose from:

- Daily average temperature, relative humidity, and wind speed (duration and amount)
- Daily precipitation amount, duration, and snow depth
- Daily average fuel temperature and solar radiation
- Min/Max plots instead of daily averages

Other plot types can be added in a modular fashion, allowing for easy customization at user request.

The entire data access portal website code is also portable for use in other regions. Alternatively, additional weather stations from other areas can be added to the same portal, and the user would still be able to easily zoom in on their area of interest using Google Maps.

Prescription window calculator

Through the data access portal, graphs of the likelihood of a prescription window occurring can be generated using user defined values for the prescription window. The user can set ranges for temperature, relative humidity, wind speed, and wind direction. The system will then search for periods when these prescription ranges are met and calculate the probabilities of such windows occurring. The user receives back a graph showing how the likelihood of the prescription window occurring varies with time.

WIMS data update (in process)

The dataset created for this project could be used to update at least the data for existing stations in WIMS. Better would be to add additional stations into WIMS. After testing the data will be made available to WIMS administrators for their

consideration. Doing so would also likely have the ancillary benefit of speeding data availability in WIMS due to the automated processes used here.

Climate associations with prescription windows (in process)

One goal of this project was to evaluate historical climate associations with common prescription window opportunities. Analyses of the overall database found only limited statistical significance to such associations, making forecasts of negliable value. Higher statistically associations may be possible by segregating the data into groups by region, elevation, etc… These analyses are ongoing. Should they prove fruitful, creation of climate based prescription window forecasts will again be considered. This analysis should be complete in 2008.

Deliverables Crosswalk Table:

Proposed	Delivered	Status
Searchable Web Interface to Data	http://airfire.org/akraws	Complete
Data Available for Download (multiple formats)	http://airfire.org/akraws	Complete
Customizable Data Plots Available Through Web	http://airfire.org/akraws	Complete
Web-based Prescription Window Probability Calculator	http://aifire.org/akraws	Complete
Automated Quality Assurance	Instructions for access at http://airfire.org/akraws	Complete
Generic Routines and Databases Packaged	Instructions for access at http://airfire.org/akraws	Complete
Data Imported into WIMS Database	TBD	In Process (see note #1)
Climate Map Types and Forecasts of Prescription Window Probablities	TBD	In Process (see note #2)
Project Presented to Land and Fire Managers at Conferences and Meetings	Presentation list below	Complete
Project Presented to Scientists at 6th Fire and Forest Meteorology and Other Conferences	Presentation list below	Complete
Yearly Accomplishment Reports to JFSP	Delivered to JFSP	Complete
Final Report to JFSP (this report)	Available at http://airfire.org/akraws	Complete

Notes:

1. The dataset created for this project is available to users through the web and is still being tested before being offered to the WIMS database in 2008.

2. Climate / prescription window forecasts are still in development. Initial work will the full dataset had limited statistical significance. However, greater statistical power may be obtained by dividing the stations by region, type, elevation, etc… If so, climate forecasts will be revisited. The analysis is expected to be complete in 2008.

Presentations Featuring This Project:

1. Larkin N.K., Shulski M., Alden S., Burgess C. November 2005. Quality assurance of Alaskan weather observations. Joint Fire Science Program All-Investigators Meeting, San Diego, California; poster, presented by Potter
2. Shulski M., Alden S., Larkin N., Wendler G. October 2005. Alaska's exceptional 2004 fire season. 6th Forest and Fire Meteorology Conference (AMS), Canmore, Alberta, Canada; oral, presented by Shulski; extended abstract published.
3. FCAMMS. October 2006. Contributions to improve national and regional predictive services. Fire Environment Working Team Meeting, Athens, Georgia; oral, presented by Fujioka.
4. Larkin N.K., Potter B., Rorig M., Solomon R. December 2006. BlueSky and FCAMMS research. Northwest Coordination Center Bi-Annual Meeting, Portland, Oregon; oral, presented by Larkin.
5. Potter B., Larkin N.K., Solomon R. February 2007. AirFire research. Washington State University Civil Engineering Seminar, Pullman, Washington; oral, presented by Potter.
6. Brown T., Larkin N.K., Lahm P. March 2007. What is the value of climate information for smoke management? 2nd Fuels Management and Fire Behavior Conference, San Destin, Florida; oral, presented by Brown, with Larkin answering questions.
7. Potter B., Larkin N.K., Krull C., Rorig M., Solomon R., Strand T. July 2007. AirFire research. USFS PNW Station Leadership Team Meeting, Wenatchee, Washington; oral, presented by Potter.
8. Larkin N.K., Potter B., Solomon R. July 2007. Research at the AirFire team: air quality forecasting, fire weather, and climate. US Forest Service Headquarters, Washington, D.C.; oral, presented by Larkin.

9. Larkin N.K., Potter B., Rorig M. May 2007. Climate research at AirFire. BlueSky Annual Meeting, Winthrop, Washington; oral, presented by Larkin.

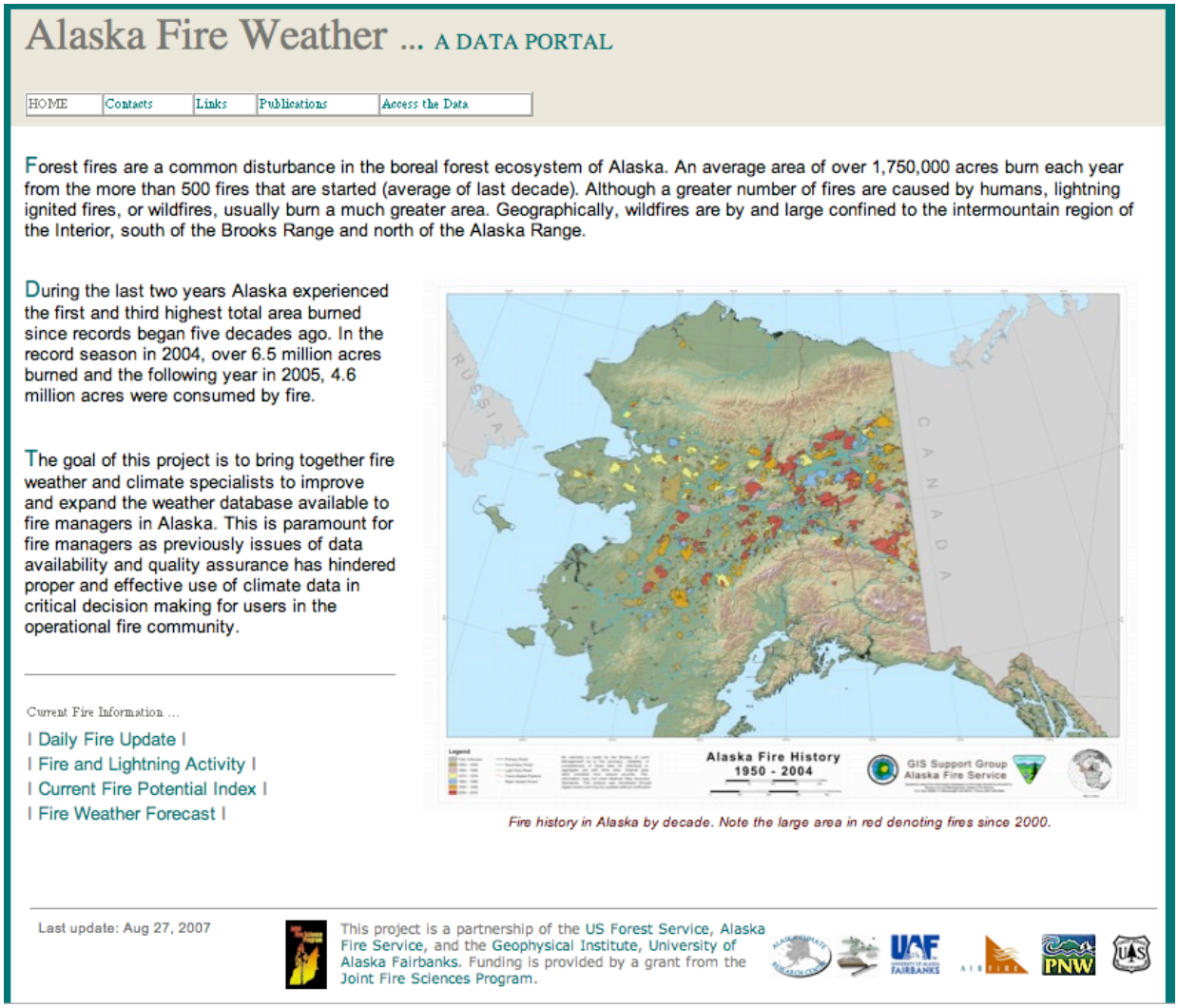

Figure 1. Data access portal website containing links to access both the project database and other information of interest to land managers in Alaska.

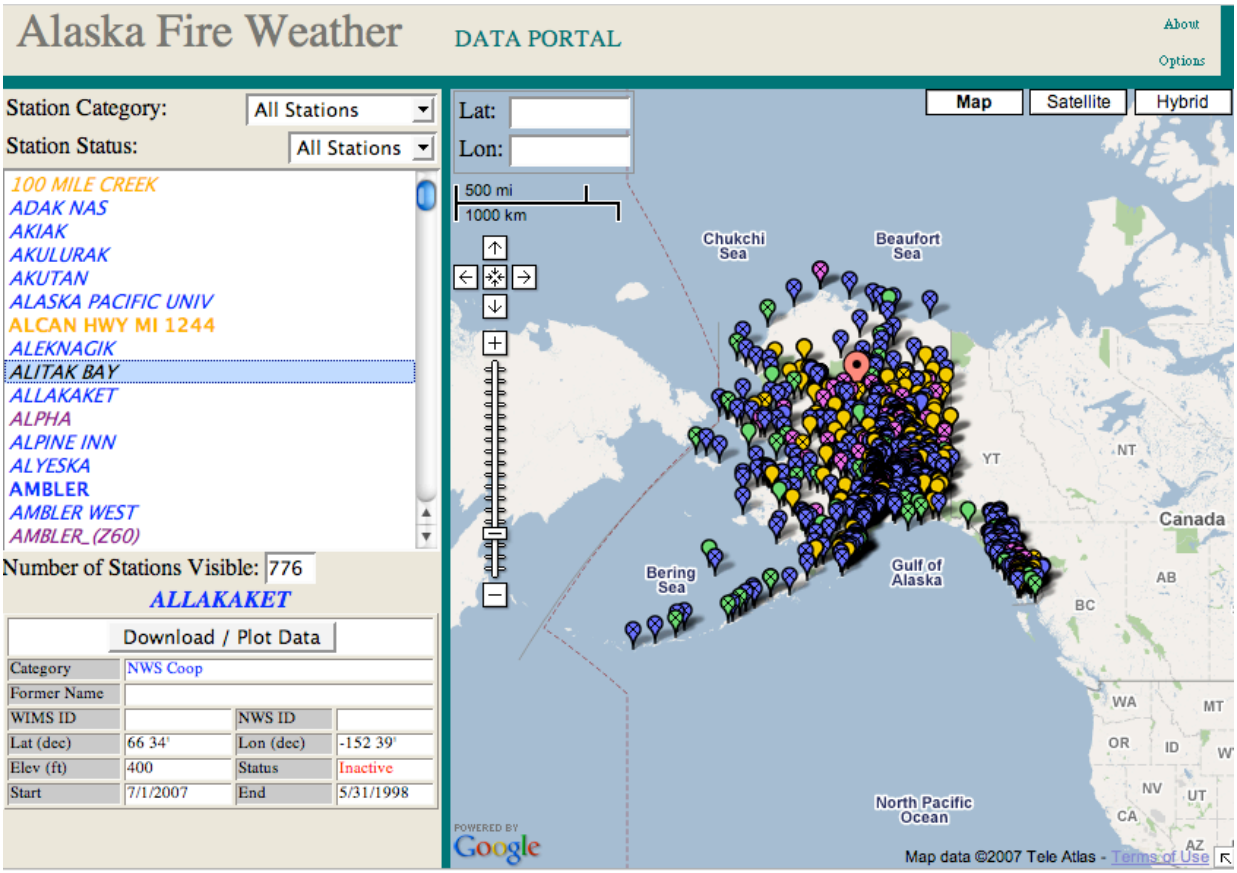

Figure 2. Data access website. Individual stations can be filtered by type, status (active/inactive), and location, and selected from a list or via the map. Once selected, additional information about the station is displayed (lower left) and access to downloading and plotting the data is provided.